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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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TEXAS INSTRUMENTS INCORPORATED			MAI, ANH D	
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DALLAS, TX 75265			PAPER NUMBER	
			2814	

DATE MAILED: 10/20/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	Application No. 10/761,691	Applicant(s) JAN ET AL.	
	Examiner Anh D. Mai	Art Unit 2814	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 20 January 2004.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 11-20 and 22 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 11-20 and 22 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 20 January 2004 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)   | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>1/20/2004</u> . | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Status of the Claims***

1. The Preliminary Amendment filed January 20, 2004 has been entered. Claims 1-10 and 21 have been canceled. Claims 11-20 and 22 are pending.

### ***Claim Objections***

2. Claims 13 and 19 are objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form.

With respect to claim 13, claim 13 recites: wherein the dry etching process to substantially remove the film from the top surface of the mask and to remove the top portion of the field oxide in the isolation region comprises a plasma etching process.

Note that the term “dry etching” of claim 11, line 10, is well known in the art to be “plasma etch”. Thus, claim 13 fails to further limit claim 11.

With respect to claim 19, claim 19 recites: wherein one or more filaments are formed between the contact structure and one or more other contact structures, the filaments being fewer in number than if a wet etching process had been used to substantially remove the film from the top surface of the mask and to remove the top portion of the field oxide in the isolation region.

As clearly indicated in the specification, the formation or lacking, of the filaments as a result of subsequent process.

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Since claim 11 does not include any subsequent process step, claim 19 claimed a limitation (process step) that had not occurred. Therefore, claim 19 fails to further limit claim 11.

3. Claim 22 is objected to because of the following informalities:

Claim 22, line 12, recites: “performing a dry plasma etching process”.

Is there a wet plasma etching process in the art ?

Since plasma etching is well known in the art to be dry etching and vice versa, the correct term should be: dry etching or plasma etching.

Appropriate correction is required.

### *Drawings*

4. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the “contact structures and one or more other contact structure” and “one or more filaments are formed” (as recites in claims 11 and 19) must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as “amended.” If a drawing figure is to be canceled, the appropriate figure

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must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. The replacement sheet(s) should be labeled "Replacement Sheet" in the page header (as per 37 CFR 1.84(c)) so as not to obstruct any portion of the drawing figures. If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

As best understood by the examiner, the contact structure is the active region.

### ***Specification***

5. The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested:

METHOD FOR FORMING LOCOS BY REMOVING THE OXIDIZED MASK FILM  
USING DRY ETCH.

### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

6. Claim 19 is rejected under 35 U.S.C. 112, second paragraph, as failing to set forth the subject matter which applicant(s) regard as their invention. Evidence that claim 19 fail(s) to

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correspond in scope with that which applicant(s) regard as the invention can be found in the disclosure. In the disclosure, applicant has stated “the improved field oxide profile may include a smaller recess with a smaller aspect ratio in the bird's beak regions of the field oxide than would be formed using previous techniques. A smaller recess may decrease or eliminate the trapping of residual particles or other materials during subsequent fabrication processes. As a result, the integrated circuit containing the semiconductor device may be less likely to include filaments that may cause failure, for example, due to a short circuit” (page 3, lines 19-25 and page 11, lines 9-15), and this statement indicates that the invention is different from what is defined in the claim(s) because claim 19 recites: “wherein one or more filaments are formed between the contact structure and one or more other contact structures, the filaments being fewer in number than if a wet etching process had been used to substantially remove the film from the top surface of the mask and to remove the top portion of the field oxide in the isolation region”.

Are there filaments formed by dry etching ?

If filaments also formed in the method using dry etch then what is the improvement since wet etch, which inventors perceive as problematic, also forms filaments.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

7. Claims 11-13, 15-20 and 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Van Der Plas (U.S. Patent No. 4,952,525) in view of Kenkare et al. (U.S. Patent No. 5,369,052).

With respect to claim 11, Van Der Plas teaches a method for improving a field oxide profile of an isolation region associated with a contact structure of a semiconductor device within an integrated circuit substantially as claimed including:

providing a mask (7) on a substrate (5) to define an active region of the semiconductor device;

exposing the substrate (5) to a thermal process and an oxygen-containing gas to grow a field oxide (8) to define an isolation region adjacent the active region and comprising the field oxide (8), a film (9) being formed on a top surface of the mask (7) during exposure to the thermal process and the oxygen-containing gas;

performing a dry etching process to substantially remove the film (9) from the top surface of the mask (7) and to remove a top portion of the field oxide (8) in the isolation region; and performing an etching process to substantially remove any portion of the mask (7) remaining after the dry etching process. (See Figs. 13-18, col. 3-6).

Thus, Van Der Plas is shown to teach all the features of the claim with the exception of explicitly disclosing the removal of the remaining portion of the mask using wet etch.

However, Kenkare teaches following removing the oxidized portion (32) of the mask (18) using wet or dry etch, performing a wet etching process to substantially remove any portion of the mask (18) remaining after the wet or dry etching process. (See Fig. 7-9, col. 4, ll. 38-47).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to remove the remaining portion of the mask of Van Der Plas using wet etch as taught by Kenkare since the etchant used to remove the mask hardly remove the material of the field oxide, thus, the final thickness of the field oxide remains acceptable for isolation.

With respect to claim 12, the substantially removing the film (9) of Van Der Plas from the top surface of the mask (7) and removing the top portion of the field oxide (8) in the isolation region occur independent of any subsequence wet etching process.

With respect to claim 13, as best understood by the examiner, the dry etching process to substantially remove the film (9) from the top surface of the mask (7) and to remove the top



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portion of the field oxide (8) in the isolation region of Van Der Plas comprises a plasma (or known as dry) etching process.

With respect to claim 15, the dry etching process to substantially remove the film (9) from the top surface of the mask (7) and to remove the top portion of the field oxide (8) in the isolation region of Van Der Plas comprises a substantially anisotropic dry etching process, the dry etching process etching the film and the top portion of the field oxide at substantially the same rate.

With respect to claim 16, the grown field oxide (8) of Van Der Plas extends underneath the mask (7) into the active region, pushing up an edge of the mask (7) and forming a "bird's beak" region (11) of the field oxide (8), a recess (10) being formed near the bird's beak region of the field oxide (8) during the dry etching process, the recess (10) having a depth as a result of the dry etching process that is inherently less than if a wet etching process had been used (see Fig. 10) to substantially remove the film (9) from the top surface of the mask (7) and to remove the top portion of the field oxide (8) in the isolation region. (See Figs. 11 and 14).

With respect to claim 17, performing the dry etching process rather than a wet etching process to substantially remove the film (9) from the top surface of the mask (7) and to remove the top portion of the field oxide (8) in the isolation region of Van Der Plas inherently substantially reduces etch-back or undercutting of the field oxide in the bird's beak region.

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With respect to claim 18, the depth of the recess (10) formed during the dry etching process of Van Der Plas is inherently at least approximately forty percent less than if the wet etching process had been used to substantially remove the film (9) from the top surface of the mask (7) and to remove the top portion of the field oxide (8) in the isolation region. (Same process same result).

With respect to claim 19, as best understood by the examiner, since the film (9) of Van Der Plas is removed by dry etching, the filaments are inherently fewer in number than if a wet etching process had been used to substantially remove the film (9) from the top surface of the mask (3) and to remove the top portion of the field oxide (8) in the isolation region.

With respect to claim 20, the field oxide (8) of Van Der Plas comprises silicon dioxide; the mask (7) comprises silicon nitride; the film (9) is inherently comprise oxynitride; and the wet etching process, in view of Kenkare, to substantially remove any portion of the mask (7) remaining after the dry etching process comprises exposure to phosphoric acid.

With respect to claim 22, as best understood by the examiner, Van Der Plas teaches a method for improving a field oxide profile of an isolation region associated with a contact structure of a semiconductor device within an integrated circuit substantially as claimed including:

providing a mask (7) on a substrate (5) to define an active region of the semiconductor device;

exposing the substrate (5) to a thermal process and an oxygen-containing gas to grow a field oxide (8) to define an isolation region adjacent the active region and comprising the field oxide (8), the field oxide (8) extending underneath the mask (7) into the active region, pushing up an edge of the mask (7) and forming a "bird's beak" region (11) of the field oxide (8), a film (9) being formed on a top surface of the mask (7) during exposure to the thermal process and the oxygen-containing gas;

performing a dry or plasma etching process to substantially remove the film (9) from the top surface of the mask (7) and to remove a top portion of the field oxide (8) in the isolation region, the film (9) being substantially removed from the top surface of the mask (7) and the top portion of the field oxide (8) in the isolation region being removed independent of any subsequent wet etching process, performance of the dry or plasma etching process rather than a wet etching process to substantially remove the film (9) from the top surface of the mask (7) and to remove the top portion of the field oxide (8) in the isolation region substantially reducing etch-back or undercutting of the field oxide (8) in the bird's beak region (11) such that a recess (10) formed near the bird's beak region (11) of the field oxide (8) during the dry or plasma etching process is inherently smaller than if a wet etching process had been used to substantially remove the film (9) from the top surface of the mask (7) and to remove the top portion of the field oxide (8) in the isolation region; and

performing an etching process to substantially remove any portion of the mask (7) remaining after the dry plasma etching process. (See Figs. 13-18, col. 3-6).

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Thus, Van Der Plas is shown to teach all the features of the claim with the exception of explicitly disclosing the removal of the remaining portion of the mask using wet etch.

However, Kenkare teaches following removing the oxidized portion (32) of the mask (18) using wet or dry etch, performing a wet etching process to substantially remove any portion of the mask (18) remaining after the wet or dry etching process. (See Fig. 7-9, col. 4, ll. 38-47).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to remove the remaining portion of the mask of Van Der Plas using wet etch as taught by Kenkare since the etchant used to remove the mask hardly remove the material of the field oxide, thus, the final thickness of the field oxide remains acceptable for isolation.

8. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Van Der Plas '525 and Kenkare '052 as applied to claim 13 above, and further in view of Babie et al. (U.S. Patent No. 5,431,772).

Van Der Plas teaches substantially remove the film (9) from the top surface of the mask (7) and to remove the top portion of the field oxide (8) in the isolation region comprises a plasma etching process using  $\text{CF}_4$ .

Thus, Van Der Plas is shown to teach all the features of the claim with the exception of explicitly disclosing the parameters (temperature, pressure, RF power and duration) of the dry etching process. Note that, the claimed parameters do not appear to be critical.

However, Babie teaches the parameters to remove a film (oxidized layer of the mask) using dry etching process including: room temperature, low pressure, RF power between 200-300 Watts. (See col. 6, ll. 45-67).

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Note that the specification contains no disclosure of either the *critical nature of the claimed parameters* of any unexpected results arising therefrom. Where patentability is aid to based upon particular chosen dimension or upon another variable recited in a claim, the Applicant must show that the chosen dimension are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to remove the film of Van Der Plas using the parameters as taught by Babie since it is well known that these parameters of the dry etch remove the film.

Regarding the duration of the etch, since the thickness of the film depends on the how thick the field oxide (8) is formed (duration of the oxidation) and the etch rate of the film with respect to etchant is known, therefore, the duration of the dry etch is readily determinable by one having ordinary skill in the art.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anh D. Mai whose telephone number is (571) 272-1710. The examiner can normally be reached on 9:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Wael Fahmy can be reached on (571) 272-1705. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

A handwritten signature in black ink, appearing to read 'Anh D. Mai', with a long, sweeping horizontal line extending to the right.

Anh D. Mai  
October 15, 2004